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<u>What is claimed is:</u>

1   1.   An image reading method for reading lines on a surface

2   of an object to be read in a sub-scanning direction and for

3   outputting image signals obtained by reading said lines to be read,

4   comprising:

5   a step of setting a number M of lines (said M is a natural

6   number being not less than two) that have to be simultaneously

7   read, an interval N (said N is a natural number being not less

8   than two) among said lines that have to be simultaneously read

9   and which is represented by lines to be read and a number L of

10   lines (said L is a natural number) by which each of said lines

11   to be read moves, every time simultaneous reading is completed,

12   from said lines whose reading has been completed, to a value that

13   can avoid omission of reading when a sequential single reading

14   is performed from a first line to be read on said surface of said

15   object to a last line to be read on said surface of said object

16   and to a value at which said lines to be read on said surface of

17   said object can be all read,

18   a step of reading said lines to be read on said surface of

19   said object to be read by moving said lines by a number of said

20   lines to be read in a sub-scanning direction when said

21   simultaneous reading has been completed and by repeating said

22   simultaneous reading on subsequent lines to be read; and

23   a step of outputting image data obtained by reading said

24   lines to be read.

1   2.   The image reading method according to Claim 1,

2   wherein values of said M, said N and said L are set to a value

3　at which there is no omission of reading lines to be read occurring

4　in said single time reading operation.

1　　　3.　The image reading method according to Claim 2,

2　wherein said first line to be read on said surface of said object

3　is a line existing backward, from a first line to be normally read

4　on said surface of said object, by predetermined numbers of lines

5　to be read which is determined based on values of said M, said

6　N, and said L, in said sub-scanning direction, while said last

7　line to be read is a line existing forward, from a last line to

8　be normally read on said surface of said object, by predetermined

9　numbers of lines to be read which is determined based on values

10　of said M, said N, and said L, in said sub-scanning direction and

11　wherein image signals of said lines to be read are image signals

12　of said first line to be normally read to said last line to be

13　normally read.

1　　　4.　An image reading apparatus for reading lines to be

2　read on a surface of an original document in a sub-scanning

3　direction and outputting image signals obtained by reading said

4　lines to be read, comprising:

5　　　a reading unit having light sensing devices that are able

6　to simultaneously read M (said M is a natural number being not

7　less than two) pieces of lines to be read which are said lines

8　to be read existing on said surface of said original document and

9　which are different lines in said sub-scanning direction, each

10　existing apart by N (said N is a natural number being not less

11　than two) pieces of lines in said sub-scanning direction;

12　　　a moving unit to move said original document and said

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13　reading unit, every time said lines are simultaneously read, by

14　L (said L is a natural numbers) pieces of said lines to be read,

15　in said sub-scanning direction;

16　　　　an image signal outputting unit to output image signals of

17　said lines to be read which have been read by said reading unit

18　in order of reading in said sub-scanning direction; and

19　　　　wherein values of said M, said N, and said L are set to a

20　value at which lines on said surface of said original document

21　are able to be read without omission of reading lines when

22　simultaneous and sequential reading operations are performed from

23　a first line to be read to a last line to be read on said surface

24　of said original document.

1　　　5.　The image reading apparatus according to Claim 4,

2　wherein values of said M, said N, and said L are set so that M

3　$\geqq 2$, $N \geqq 1 + M$, and $L = N - 1$.

1　　　6.　The image reading apparatus according to Claim 5,

2　wherein value of said N is set so that $N = 1 + M$.

1　　　7.　The image reading apparatus according to Claim 4,

2　wherein values of said M, said N, and said L are set so that M

3　$\geqq 2$, $L = M$, and that a greatest common measure of values of said

4　L and said N, equals one.

1　　　8.　The image reading apparatus according to Claim 4,

2　wherein values of said M, said N, and said L are set so that M

3　$\geqq 2$, $1 < L \leqq M$ and that a greatest common measure of values of

4　said L and said M equals one.

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1　　　　9.　　The image reading apparatus according to Claim 8,

2　wherein values of said M and said L are set so that M = L.

1　　　　10.　　The image reading apparatus according to Claim 8,

2　wherein values of said M and said L are set so that $1 < 1 + L <$

3　$1 + M$.

1　　　　11.　　The image reading apparatus according to Claim 4,

2　wherein said image outputting unit includes:

3　　　　an analog to digital converting circuit to analog to digital

4　convert image signals of M pieces of lines to be read which have

5　been output from said reading unit;

6　　　　a storing device to store pixel data obtained by conversion

7　by said analog to digital converting circuit; and

8　　　　a reading control circuit to read said pixel data stored

9　in said storing device in order of reading in said sub-scanning

10　direction.

1　　　　12.　　The image reading apparatus according to Claim 11,

2　wherein said reading unit starts said reading operation from a

3　line existing backward in said sub-scanning direction by a

4　predetermined number of lines to be read that are determined based

5　on values of said M, said N, and said L from said first line to

6　be normally read and performs reading operations up to a line

7　existing forward in said sub-scanning direction by said

8　predetermined number of lines to be read that is determined based

9　on values of said M, said N, and said L and wherein said storing

10　device stores only said pixel data obtained by reading lines to

11　be normally read and output from said analog to digital converting

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12　circuits.

1　　　13.　　The image reading apparatus according to Claim 12,

2　wherein said reading device is constructed as a color reading

3　device, and wherein an image processing circuit for gray-level

4　correction is provided between said storing device and said analog

5　to digital converting circuit making up said image signal

6　outputting.

1　　　14.　　An image reading apparatus for reading lines to be

2　read on a surface of an original document in a sub-scanning

3　direction and outputting image signals obtained by reading said

4　lines to be read, comprising:

5　　　a reading means having light sensing devices that are able

6　to simultaneously read M (said M is a natural number being not

7　less than two) pieces of lines to be read which are said lines

8　to be read existing on said surface of said original document and

9　which are different lines in said sub-scanning direction, each

10　existing apart by N (said N is a natural number being not less

11　than two) pieces of lines in said sub-scanning direction;

12　　　a moving means to move said original document and said

13　reading means, every time said lines are simultaneously read, by

14　L (said L is a natural numbers) pieces of said lines to be read,

15　in said sub-scanning direction;

16　　　an image signal outputting means to output image signals

17　of said lines to be read which have been read by said reading means

18　in order of reading in said sub-scanning direction; and

19　　　wherein values of said M, said N, and said L are set to a

20　value at which lines on said surface of said original document

21 are able to be read without omission of reading lines when

22 simultaneous and sequential reading operations are performed from

23 a first line to be read to a last line to be read on said surface

24 of said original document.

1   15.   The image reading apparatus according to Claim 14,

2   wherein said image outputting means includes:

3   an analog to digital converting circuit to analog to digital

4   convert image signals of M pieces of lines to be read which have

5   been output from said reading means;

6   a storing device to store pixel data obtained by conversion

7   by said analog to digital converting circuit; and

8   a reading control circuit to read said pixel data stored

9   in said storing device in order of reading in said sub-scanning

10 direction.

1   16.   The image reading apparatus according to Claim 15,

2   wherein said reading means starts said reading operation from a

3   line existing backward in said sub-scanning direction by a

4   predetermined number of lines to be read that are determined based

5   on values of said M, said N, and said L from said first line to

6   be normally read and performs reading operations up to a line

7   existing forward in said sub-scanning direction by said

8   predetermined number of lines to be read that is determined based

9   on values of said M, said N, and said L and wherein said storing

10 device stores only said pixel data obtained by reading lines to

11 be normally read and output from said analog to digital converting

12 circuits.

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1　　　17.　The image reading apparatus according to Claim 21 or

2　Claim 16, wherein said reading device is constructed as a color

3　reading device, and wherein an image processing circuit for

4　gray-level correction is provided between said storing device and

5　said analog to digital converting circuit making up said image

6　signal outputting.